

Claims

1. A directional display apparatus comprising:

a spatial light modulator comprising an array of pixels; and

a lens array having a structure which repeats at a predetermined pitch,

wherein the directional display apparatus is arranged such that, in respect of sections of the lens array at said predetermined pitch, each respective section is capable of directing light from at least one pixel aligned with the respective section into at least one nominal viewing window, and each respective section is also capable of directing light from at least one adjacent pixel aligned with a section adjacent the respective section into the same at least one nominal viewing windows.

2. A directional display apparatus according to claim 1, wherein the directional display apparatus is

arranged such that each respective section is also capable of directing light from at least one adjacent pixel

aligned with sections adjacent the respective section on opposite sides of said respective section into the same at least one nominal viewing windows.

3. A directional display apparatus according to claim 1 or 2, wherein the lens array is arranged such that

each respective section is capable of said directing of light from said at least one adjacent pixel into said same at least one nominal viewing windows.

4. A directional display apparatus according to claim 3, wherein each respective section of the lens array has at least one lens surface providing:

at least one first region capable of directing light from said at least one pixel aligned with the respective section into said at least one nominal viewing window; and

at least one second region capable of directing light from said at least one adjacent pixel into the same at least one nominal viewing windows.

5. A directional display apparatus according to claim 4, wherein said at least one lens surface provides a plurality of said first regions arranged alternately with a plurality of said second regions.

6. A directional display apparatus according to claim 4 or 5, wherein said at least one lens surface has no vertical facets between said first and second regions.

7. A directional display apparatus according to claim 1 or 2, wherein

the lens array has at least one lens surface capable of directing light from at least one pixel aligned with the respective section into said at least one nominal viewing window and

the directional display apparatus further comprises a deflection element arranged to deflect a portion of the light from at least one pixel aligned with said adjacent section passing through each respective section of the lens array by an amount which causes said at least one lens surface to direct said light from said at least one pixel

aligned with said adjacent section into said same at least one nominal viewing window.

8. A directional display apparatus according to claim 7, wherein said deflection element comprises a hologram.

9. A directional display apparatus according to claim 7, wherein said deflection element comprises a prism element.

10. A directional display apparatus comprising:
a spatial light modulator comprising an array of pixels; and
a lens array having a structure which repeats substantially at a predetermined pitch,
wherein the lens array is arranged such that each respective section of the lens array at said pitch is formed to provide:

at least one first region capable of directing light from at least one pixel aligned with the respective section into at least one nominal viewing window; and

at least one second region capable of directing light from at least one adjacent pixel aligned with a section adjacent the respective section into the same at least one nominal viewing window.

11. A directional display apparatus according to claim 10, wherein the lens array is arranged such that the at least one second region is capable of directing light from at least one adjacent pixel aligned with sections adjacent the respective section on opposite sides of said respective section into the same at least one nominal viewing window.

12. A directional display apparatus according to claim 10 or 11, wherein the lens array is arranged such that each respective section of the lens array is formed to provide a plurality of said first regions arranged alternately with a plurality of said second regions.

13. A directional display apparatus according to any one of claims 10 to 12, wherein each respective section of the lens array has at least one lens surface shaped to provide said first and second regions.

14. A directional display apparatus according to claim 13, wherein said at least one lens surface has no vertical facets between said first and second regions.

15. A directional display apparatus according to any one of claims 4 to 6 or 10 to 14, wherein the at least one second region has substantially the same imaging function as the at least one first region of said adjacent section.

16. A directional display apparatus according to any one of the preceding claims, wherein said at least one pixel aligned with a section of the lens array is a group of pixels and said at least one nominal viewing window is

a group of nominal viewing windows.

17. A directional display apparatus according to any one of the preceding claims, wherein the lens array is a birefringent lens array.

5

18. A directional display apparatus according to claim 17, wherein the birefringent lens array is a passive element and the directional display apparatus further comprises a switchable polariser arranged to control the polarisation component of light passing through the lens array and output from the directional display apparatus.

10 19. A directional display apparatus according to claim 17, wherein the birefringent lens array is an active element which is switchable to control the effect of the lens array.

15 20. A directional display apparatus according to claim 19, wherein the active element comprises an isotropic material, a birefringent material, a microstructured interface between the isotropic material and the birefringent material and conductive electrodes formed on opposite sides of the birefringent material.

21. A lens array for controlling the output of a spatial light modulator comprising an array of pixels in a display apparatus, the lens array having a structure which repeats at a predetermined pitch,

wherein each respective section of the lens array at said pitch is formed to provide:

20 at least one first region capable of directing light from at least one pixel of the spatial light modulator aligned with the respective section, when the lens array is arranged in series with the spatial light modulator, into at least one nominal viewing window; and

25 at least one second region capable of directing light from at least one adjacent pixel aligned with a section adjacent the respective section, when the lens array is arranged in series with the spatial light modulator, into the same at least one nominal viewing window.